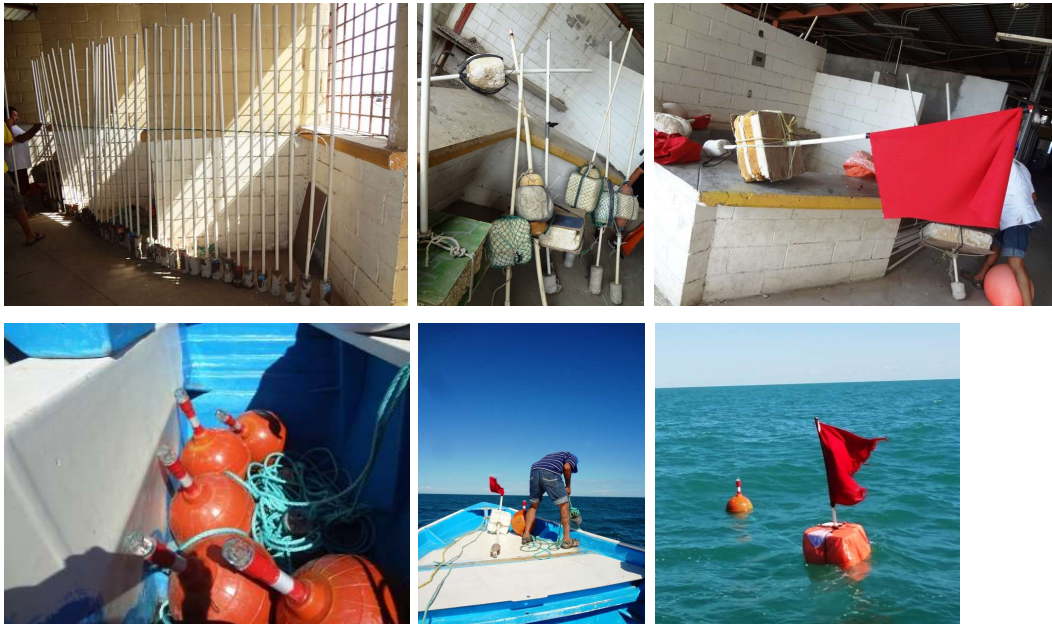


SECOND REPORT OF ACOUSTIC RESEARCH

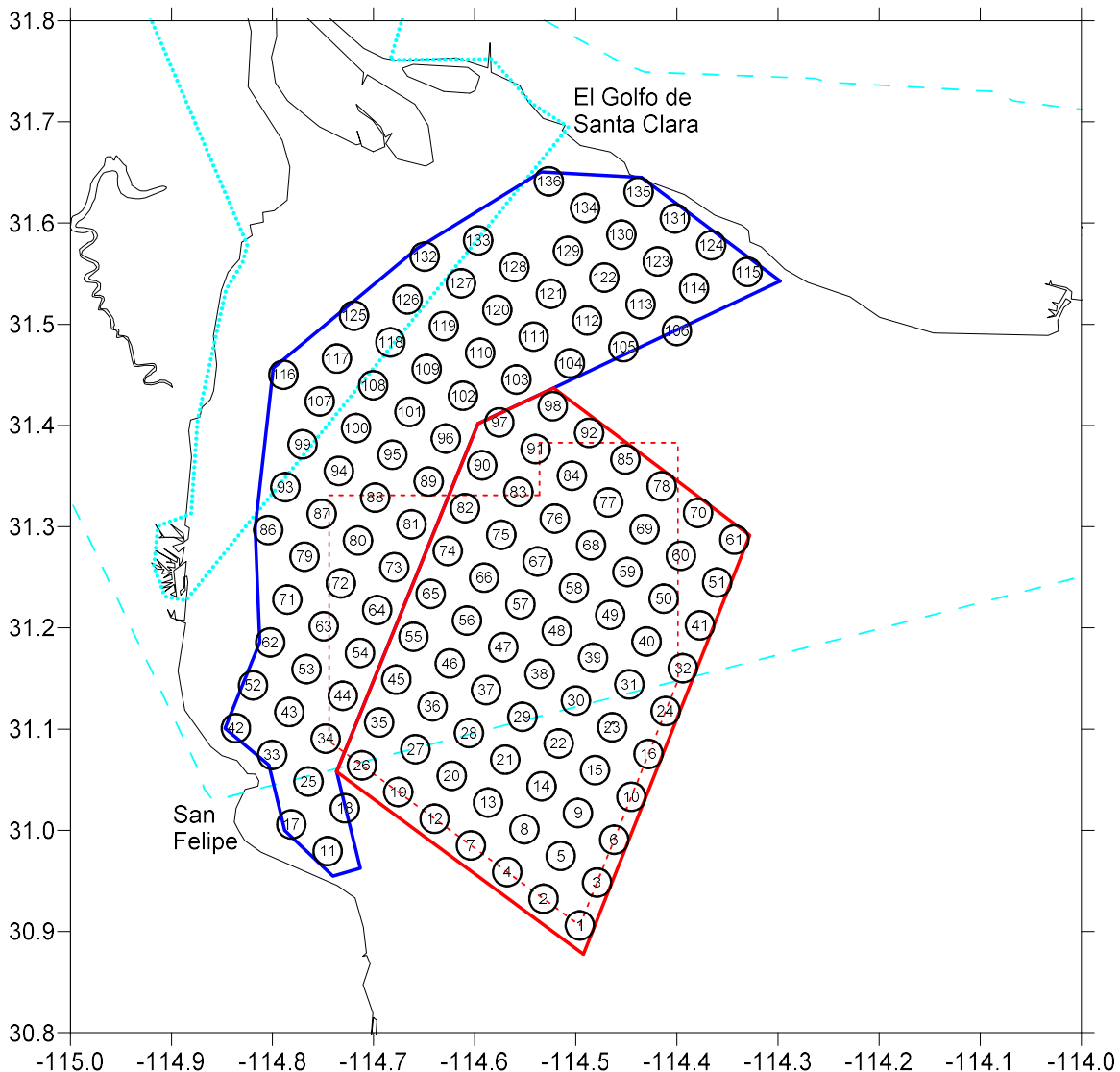
NOVEMBER 9TH, 2015

The moorings to hold the acoustic detection devices (C-POD) include a rigid vivid colored buoy, equipped with a strobe light for good visibility in the dark. The color makes the buoy easy to see during the daylight hours, but because the buoys are only about one foot in diameter they can be hard to see with any swell. Therefore, we installed flags to enhance visibility and avoid boat collisions with the moorings. Flags are mounted in structures made with PVC poles, with a concrete weight on one extreme and a floating device at about one meter from the weight. This design keeps the pole vertical using same design used by local fishermen to mark the position of fishing gear. The flag is made of a resistant red color fabric. The flag structure is attached to the buoys by a 5 meter rope. The flags and structures were made by our field team the week of October 19th, installation in the actual mooring buoys occurred between October 21st and November 4th. In some cases installation of flags occurred when acoustic detectors were exchanged.

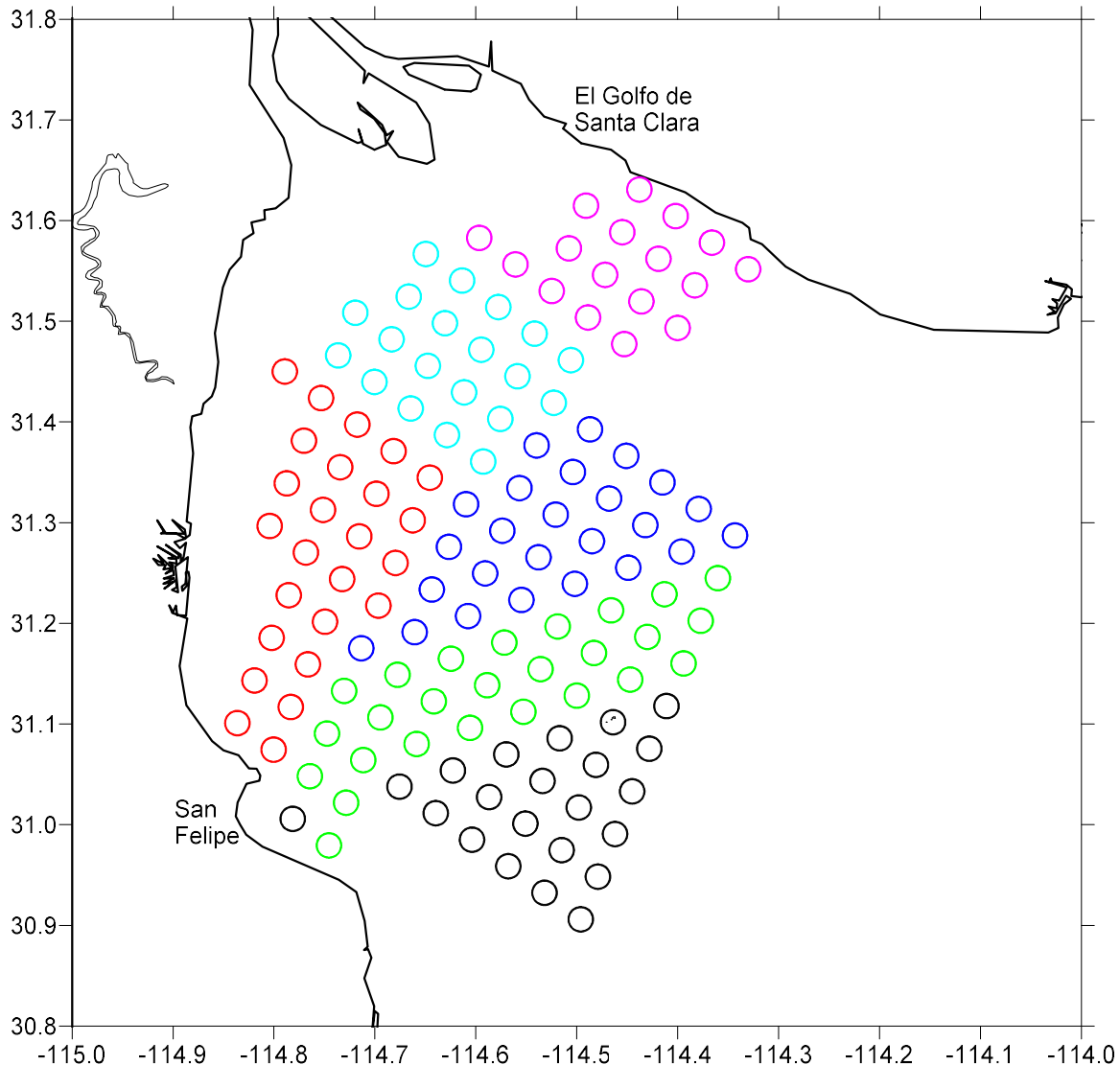


Images of assembling and deploying flag structures. The first step was to fix a weight made of concrete to one extreme of the poles. Second step was to fix floating material at one meter from the weight. Finally, a red flag was fixed in the free end of the pole. The structure holding the flag is attached to the mooring buoys with a 5 meter rope.

As planned, acoustic detectors were exchanged in the 135 sampling sites between October 21st and November 4th. Our six field teams, called Campoy, Samudio, Valverde, Sánchez, Castro and Chalunga, complete the work in six days when weather allowed safe navigation (October 21, 26, 27 and 28; November 1 and 4). Daily journeys took nine hours, from departure to arrival in San Felipe.



Map of a portion of the Upper Gulf of California, showing the position of San Felipe and El Golfo de Santa Clara. Light blue lines delimit the Biosphere Reserve (solid for the nuclear zone, dashed for the buffer zone). Dashed red lines outline the Vaquita Refuge. Black circles and labels represent acoustic sampling sites. The ones inside the red polygon are in the calibration area where visual surveys are also done. The ones inside blue polygon are in shallow waters monitored exclusively with acoustics.



Map showing how the sampling sites were assigned to every one of the six field teams to do the first exchange of acoustic detectors. Circles represent the position of the sampling sites. Black sites assigned to team Sánchez, green to team Valverde, red to team Zamudio, blue to team Campoy, cyan to team Castro and purple to team Chalunga.

Data analysis

In total 144 CP1 type files were obtained, with a total size of 69.1 GB (74,195,560,038 bytes). These were processed with the algorithm KERNO, of the CPOD.exe program, to create the correspondent CP3 type files, which contain information only of the moments when potential porpoises, dolphins, sonars or other signals different to background noise were detected.

Once the CP3 files were created (144, one for every CP1 file) analysts reviewed to identify certain vaquita acoustic detections. The review of data took nine days.

The data reported here is for acoustic detections between September 27th and November 3rd (38 days). Review of acoustic detections resulted in about 544 vaquitas events, including 72,922 clicks (the kind of sound that vaquitas produce).

Where we find vaquitas... acoustically

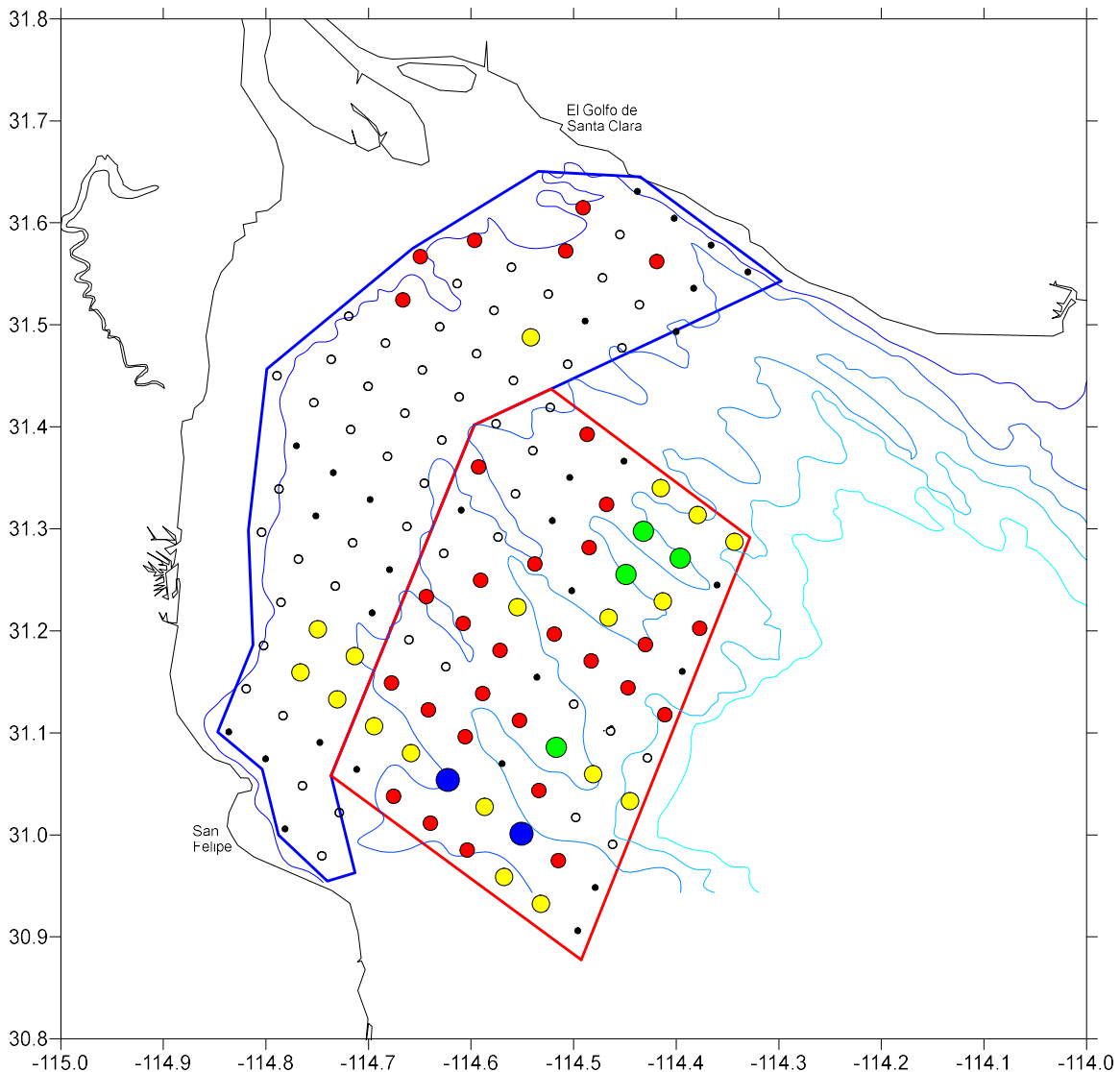
Although we lost some of the acoustic detectors, is clear that acoustic encounters of vaquitas occurred in practically all of the calibration zone, with a noticeable absence or low density towards north. The spot with the highest density or acoustic activity is in the southern portion of calibration area, but with a spot of high activity towards northeast. These results are similar to the ones obtained between 2011 and 2015, in the period June to September, during the regular sampling periods of the acoustic monitoring program of vaquita.

In the northern portion of the shallow area unexpected results were obtained. Although we had some earlier data indicating the presence of vaquitas in this area, the amount found with CPODs was surprising. Although the density of clicks (average number of clicks per day per sampling site) is low, it was not a single, isolated event. Instead, vaquita events occurred on several days, indicating that vaquita individuals tend to visit the zone periodically for some time (i.e. not just transiting).

In this area close to the Colorado River Delta, vaquitas were detected on eight different days between September 30th and October 24th. In total, 21 vaquita events occurred, with three days when presence was higher (September 30th with 7 events, October 1st with 4 and October 24th with 5).

Another spot of acoustic activity outside calibration zone was in the southern portion of the shallow area, north of San Felipe. The presence of vaquitas was similar to the northern portion with 28 events. Higher density of clicks were found here. In the south events occurred on 11 days, between October 1st and 20th. Events do not appear in pulses like in the north, but a similar

number of vaquitas apparently visit the area on every day with detections. This southern shallow-water spot is also close to the area of highest acoustic activity, so it is probably the edge of this good habitat.



Map showing the distribution of vaquita acoustic activity during the sampling period from September 27 to November 3. Black dots show sites where we lost acoustic detectors. No activity was detected in the sites indicated with a small black circle. Sites in red indicate an average low activity (up to 10 clicks per day), yellow a middle activity (up to 100 clicks per day), green a high activity (up to 300 clicks per day) and blue a very high activity (up to 600 clicks per day). Acoustic activity occurs in almost all the calibration area sites (red polygon). An interesting area of activity is in the northern portion of shallow area (blue polygon). This area appears to be separated from the rest of the active sites, including the other site with activity in the same shallow area.

Soon we will start the second period of acoustic detectors exchange, so we will know if the same distribution pattern of vaquita acoustic activity repeats. However, it is exciting to know that vaquitas are still in the Upper Gulf.